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On the occurrence and distribution of two subspecies of *Mus musculus* Linnaeus, 1758 (Rodentia, Murinae) in the Netherlands¹

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Introduction

In 1941, W. J. MAAN, at that time assistant of the Zoological Museum in Amsterdam, mentioned in a popular book on the flora and fauna of the town of Amsterdam, the occurrence of two subspecies of the House Mouse. For these subspecies he used the names *Mus musculus* (*domesticus*) and *Mus musculus hortulanus*. The second subspecies he described as (translated): „An aberrant form with yellow-brown-coloured back and a white belly, I often obtained from the garden of (the Zoo) Artis, where this animal lives in freedom.“ The occurrence of the last-mentioned subspecies in the Netherlands was cited, although with a certain amount of doubt, in faunistical and systematical publications by later authors (e. g. IJSSELING & SCHEYGROND, 1943 & 1950 and VAN LAAR, 1961). It must be emphasized that the publication of MAAN (1941) appeared previous to the two important revisions of the genus *Mus* Linnaeus, 1758 by SCHWARZ & SCHWARZ (1943) and by ZIMMERMANN (1949). At that time the nomenclature and taxonomy of wild and commensal House Mice was in a state of utter confusion.

Our research was meant to check the results of MAAN (loc cit.) and to gather more faunistical and systematical data on the House Mouse in the Netherlands, by studying an extensive collection of skins and skulls and by using modern literature.

Material

In total we studied 327 specimens of *Mus musculus* from the Netherlands. Thanks to the kind cooperation of Dr. A. M. HUSSON, the curator of the Mammal Department of the Rijksmuseum van Natuurlijke Historie at Leiden, it was possible to borrow and to study material of this Museum. The animals of the Leiden museum came from: Leiden 45, Voorschoten 29, N. O. Polder 19, Goes 10, Elspeet 9, Amsterdam 6, Winterswijk 6, Eindhoven 5, Rotterdam 5, Heythuizen 4, Noordwijk 4, Epse 4, Wieringermeer 4, Sneek 3, Leerdam 3, Zoeterwoude 2, Ellemeet 2, Herwijnen 2, Joure 2, Wilhelminaldorp 2, Abbega 1, Amstenrade 1, Angerlo 1, Asperen 1, Barneveld 1, Bruns-

¹ In honour of the 70th birthday of Dr. ERNA MOHR and of Prof. Dr. K. ZIMMERMANN.

sum 1, Ede 1, Heemstede 1, Heerlen 1, Hulshorst 1, Maastricht 1, Renkum 1, Schimmert 1, Tegeler 1, Twello 1, Utrecht 1, Wolvega 1.

From the Zoological Museum in Amsterdam we could study material from: Amsterdam-Zoo 81, Amsterdam-town 12, Rotterdam 9, Maastricht 6, Rekem (Belgium, near the Dutch border) 6, Mook 4, Vlieland 4, Breda 3, Montfort (L.) 3, Wormerveer 3, Texel 2, Wilp 2, Amstelveen 1, Bergen 1, Doornspijk 1, Gennep 1, Haamstede 1, Terneuzen 1. The numbers behind the names of the communities indicate the number of specimens.

Our thanks are due to Dr. A. M. HUSSON, the management and the wardens of the Amsterdam Zoo „Natura Artis Magistra“, the management and the wardens of the Rotterdam Zoo „Blijdorp“, and to other persons who helped us by furnishing House Mice. In particular Mr. W. R. VAN MOURIK collected many interesting animals.

Methods

In the taxonomy of House Mice the relation of the length of the head and body to the length of the tail is rather important. As this relation is different in young animals as compared to adult ones (e. g. MOHR, 1928 and SILVONEN, 1954), we took care to separate the two groups and to study only full-grown mice. According to the state of toothwear, we divided our rodents into three categories and well: (I) none of the molars are worn or only the last one shows some wear (age group 1 and 2 according to FELTEN, 1952), (II) the second and third molar are showing clear signs of wear (age group 3 of FELTEN) and (III) all molars are clearly worn (age group 4 and 5 according to FELTEN).

We furthermore divided our animals into three groups according to the general aspect of the skull. Into the first group (1) we put rodents having rather round skulls with somewhat transparent braincases, of which the sutures were not yet completely ossified and in which the width over the zygomatic arches was smaller than the mastoid breadth. In the second, transitory group (2), we put animals neither belonging to the first nor to the following group. The third group (3) contained animals of which the skulls were full-grown, viz. with completely ossified sutures, with a flattened, solid braincase and with a zygomatic breadth larger than the mastoid breadth.

By uniting the two sets of criteria we obtained (age) groups ranging from I:1 to III:3. For our further work we used only the groups II/III:2/3. We considered these being full-grown adult animals. Being full-grown adult has little to do with being sexually adult. As an example of this we may cite the results we obtained in animal ZMA 4664. This was a female with 8 embryos, which was classified I:2. This animal was not used further in our studies.

Of the intact rodents the head-body length (tip snout-anus), the tail length (anus-fleshy tip of the tail), the ear length and the length of the hindfoot (without nail) was measured. Of the skulls we ascertained, besides the classical measurements, the dimensions of the nasalia (length of the suture between the nasalia) and the height of the rostrum (from the anteriormost part of the alveolus of M^1 , perpendicular to the diastema). All measurements were taken with a vernier calliper to the nearest tenth of a millimeter.

In studying the skins we noted the colour of the back, the colour of the belly, the presence of a demarcationline between the colours of the back and the belly and the presence of black guardhairs among the short hairs of the underside of the animal. All the animals were compared to a number of 'standard' specimens and those 'standard' specimens were later on compared to the colourguides of RIDGWAY (1912) und OSTWALD (1939).

Results and discussion

One of the results of our study is the confirmation of the statement of MAAN (1941) on the occurrence of two subspecies of *Mus musculus* in the town of Amsterdam. *Mus musculus musculus* Linnaeus, 1758 is found in the gardens of the Amsterdam Zoo together with *Mus musculus domesticus*. In the remainder of the town only *Mus musculus domesticus*, Ratty, 1772, is found. The subspecies *Mus musculus musculus* was also found in the communities Leiden, Noordwijk and Zoeterwoude as well as in the Noord-Oost Polder (the Northeastern polder in the former Zuyder Sea); see map.



Map of the Netherlands with the localities where the studied material of *Mus musculus* originated

Body- and skull dimensions of *Mus musculus* from the Netherlands (n = number of specimens measured, m = mean dimension, s. d. = standard deviation).

All measurements in millimeters

	<i>M. m. domesticus</i> ♀♀			<i>M. m. domesticus</i> ♂♂			<i>M. m. musculus</i> ♂♂		
	n	m	s. d.	n	m	s. d.	n	m	s. d.
l. Head-Body . . .	44	84.27	10.50	54	81.96	8.77	11	85.18	5.91
l. Tail	43	82.44	7.00	53	81.79	8.08	11	88.09	5.50
T in % HB . . .	43	98.77	10.77	53	100.89	13.70	11	104.27	9.16
Hindfoot	42	18.62	1.90	55	18.29	2.97	11	18.32	1.10
Ear	14	13.75	1.44	27	12.96	1.16	10	13.50	1.49
Cond. bas. l. . .	33	20.78	1.03	50	20.45	1.00	14	21.06	0.63
L. nasalia . . .	39	7.71	0.78	61	7.61	0.62	16	8.29	0.57
Nas. in % Cbl. .	30	36.03	7.35	44	36.98	1.98	14	39.14	2.11
Zygom. b. . . .	36	11.41	0.48	54	11.17	0.48	11	11.55	0.40
Mast. b.	38	9.91	0.20	58	9.90	0.30	13	9.80	0.25
Max. toothrow .	48	3.68	0.79	73	3.66	0.20	16	3.76	0.14
Mand. l.	50	12.56	0.64	75	12.39	0.63	16	12.91	0.49
Diastema	48	5.80	0.35	68	5.76	0.37	16	5.91	0.92
Rostral h. . . .	50	5.06	0.24	73	5.04	0.27	16	5.18	0.94

The two subspecies can be separated only as full-grown animals and only by the colours and the colour distribution of the skin. Following SCHWARZ & SCHWARZ (1943) and ZIMMERMANN (1949) we can characterize the two subspecies as follows:

Mus musculus domesticus

Belly somewhat lighter coloured than the back.

No clear demarcation between the fur colours of the back and the belly.

Fur of the belly and breast with long black guardhairs between short grey hairs..

Mus musculus musculus

Back dark; brown or brown-grey.

Fur on the underside yellowish or grey-white.

A clear demarcationline between the colours of the upper- and the underside, sometimes accented by yellow hairs.

From some communities, e. g. Elspeet, Maastricht, Montfort (L.), Rekem, Wormerveer and from the Island of Vlieland, we received specimens of *Mus musculus*, intermediate in appearance to the subspecies *musculus* and *domesticus*. As we studied only a small number of specimens from these localities, we do not attach great value to these findings. In both subspecies the variability is rather large.

Although we found some differences in dimensions between the two subspecies, the overlap of the measurements is so large, that these data cannot be used to differentiate the subspecies (see table).

The occurrence of *Mus musculus domesticus* in the Netherlands was to be expected, as this is the normal subspecies found in occidental Europe (ZIMMERMANN, 1949, map nr. 1 on page 312; ELLERMAN & MORRISON-SCOTT, 1951; MOHR, 1954). That also *Mus*

musculus musculus was found is rather unexpected but can be explained by unintentional importation from the region of the river Elbe. Escaped laboratory mice, mice hidden in the hay of imported Zoo animals and mice coming into the country with imported merchandise can be the origin of more or less isolated populations. Of the Noord-Oost Polder it is known that during the German occupation from 1940 till 1945 the first grain sowed on the reclaimed land was coming from East Germany. Whether these populations of *Mus musculus musculus* will remain or they will disappear by interbreeding with the surrounding and far more numerous populations of *Mus musculus domesticus* can only be ascertained by further study.

It may be remarked that in the studied material we only found some House Mice, coming from a cold store in Amsterdam, in which a reduction of the third upper molar had taken place (HEROLD & ZIMMERMANN, 1960) (Leiden collection numbers RMNHL 417, 417a–417e). It may also be noted that we found in a population of *Mus musculus domesticus*, living in a non-heated aviary at Maastricht, a behaviour as known in the feral subspecies *Mus musculus spicilegus* Petenyi, 1882. The Maastricht animals constructed burrows in the earth, in which they lived and stored their food (see e. g. FESTETICS, 1961).

Summary

Beside the normal West-European subspecies *Mus musculus domesticus*, this study confirmed the existence of isolated populations of *Mus musculus musculus* in some communities in the Western part of the Netherlands and in the Noord-Oost Polder. The populations of *Mus musculus musculus* originate probably from unintentionally imported animals from East of the river Elbe.

Zusammenfassung

Neben der für Westeuropa normalen Unterart *Mus musculus domesticus* wird durch die hier vorliegende Studie das Vorkommen isolierter Populationen von *Mus musculus musculus* in einigen Gemeinden im Westen der Niederlande und im Nordost-Polder nachgewiesen. Die Populationen von *Mus musculus musculus* sind wahrscheinlich auf unabsichtliche Einschleppung von östlich der Elbe zurückzuführen.

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Notes on *Hippotragus niger roosevelti* (Heller, 1910)¹

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Without a doubt, the tribe Hippotragini Simpson, 1945, contains some of the most impressive of those artiodactyls we call antelopes. This tribe, comprised of the three recent genera *Hippotragus* Sundevall, 1846; *Oryx* De Blainville, 1816; and *Addax* Rafinesque, 1815, is predominantly African in distribution, although a single species *Oryx leucoryx* (Pallas, 1777), the almost extinct Arabian Oryx, does reach southwestern Asia. In its geological history members of this particular tribe, of which there are fourteen fossil genera, can be traced back as far as the Lower Pleistocene of Europe and Asia. As far as is known the Hippotragini only appeared in Africa during the Pleistocene, making this continent their stronghold and evolving into the forms which we know today.

Of the recent genera *Addax* contains but a single species, *nasomaculatus* (BLAINVILLE, 1816) with no recognized subspecies. *Oryx*, on the other hand, has three species; *tao* (H. SMITH, 1827) with no subspecies; *leucoryx* (PALLAS, 1777) with no subspecies; and *gazella* (LINNÉ, 1758) with five presently recognized subspecies. The validity of certain *gazella* subspecies is open to question.

Hippotragus, like *Oryx*, also has three species. The first of these *Hippotragus leucophaeus* (PALLAS, 1766) is the now extinct Blaaubok (fig. 1.) of the



Fig. 1. Adult male Blaaubok, *Hippotragus leucophaeus* (Pallas, 1766) from the environs of Swellendam, Cape Province. (Photo: Rijksmuseum van Natuurlijke Historie, Leyden)

¹ For Dr. Erna Mohr, 70 years old.